Innovazione Digitale in Sanità
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Un Robot assistivo per pazienti con demenza: il progetto europeo MARIO.

Daniele Sancarlo

Geriatrics Unit & Laboratory of Gerontology and Geriatrics, Department of Medical Sciences, IRCCS "Casa Sollievo della Sofferenza", San Giovanni Rotondo

MARIO

Managing active and healthy aging with use of caring service robots

Call Topic: PHC 19-2014 - Advancing active and healthy ageing with ICT: Service robotics within assisted living environments
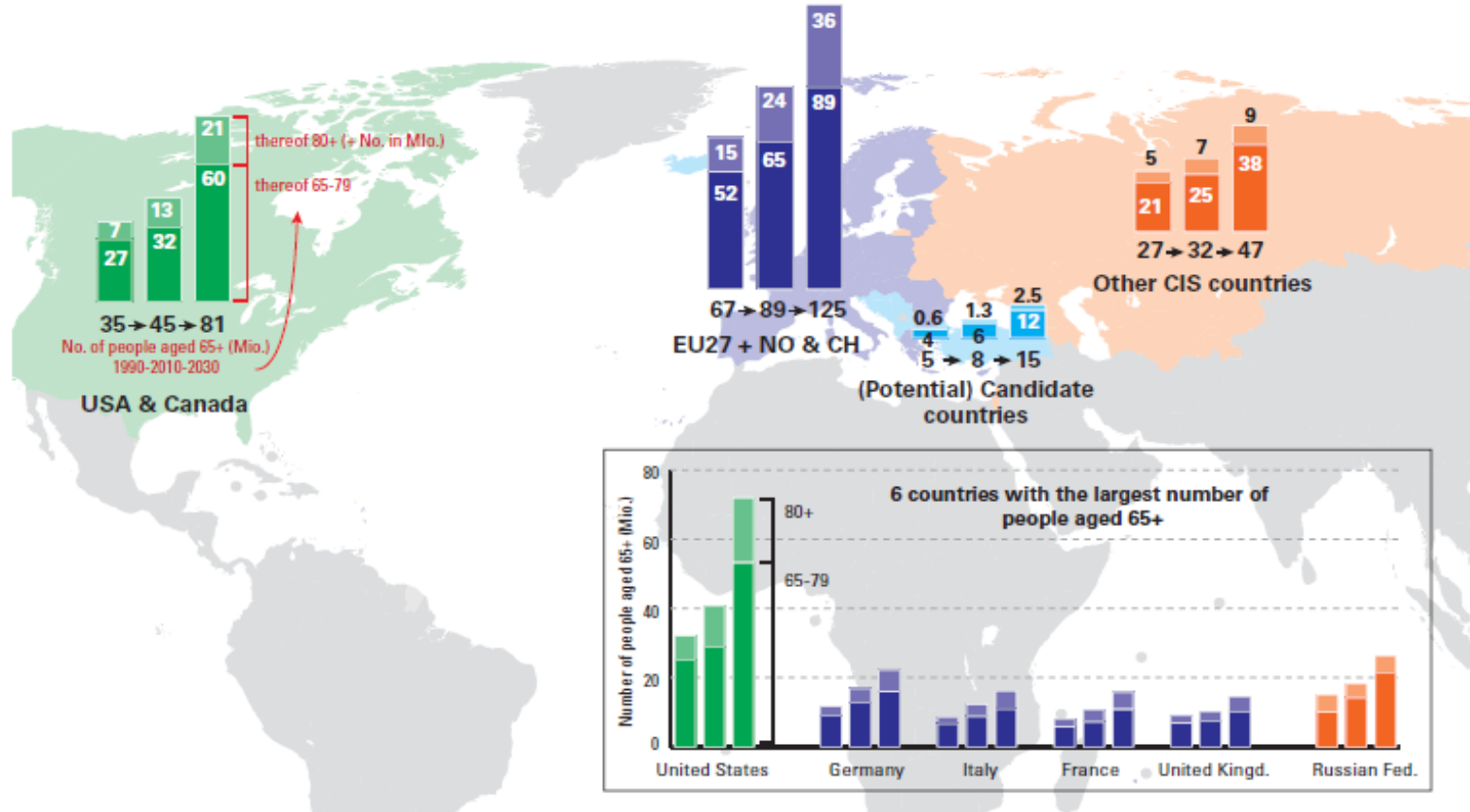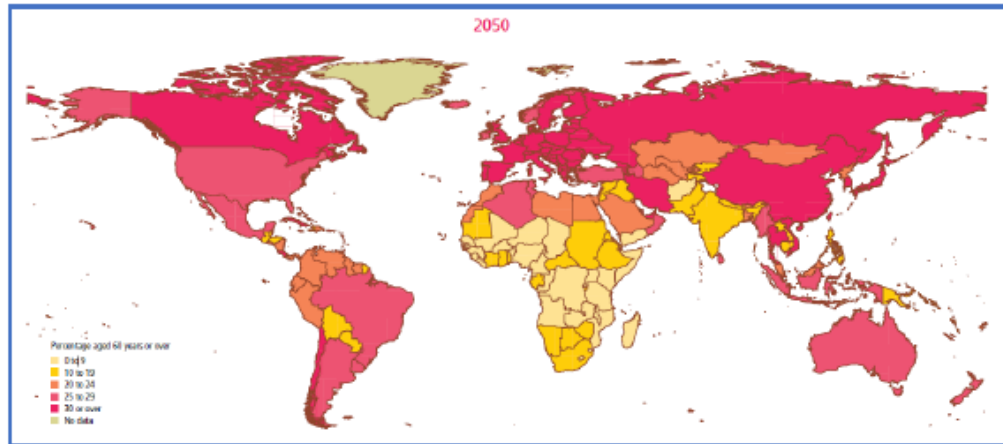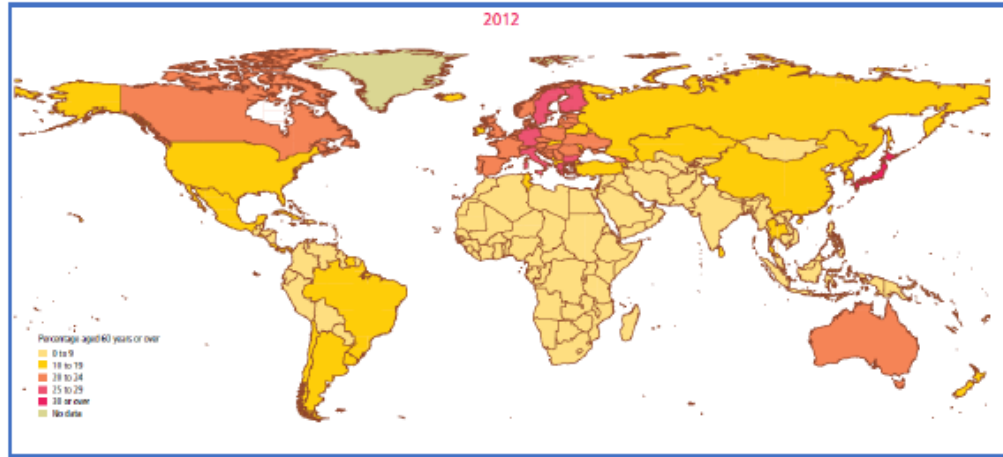
Partners

- ✓ National University of Ireland, Galway
- ✓ ROBOSOFT
- ✓ RU Robot
- ✓ Ortelio Ltd
- ✓ City of Stockport
- ✓ Consiglio Nazionale delle Ricerche
- ✓ R2M Solution
- ✓ Casa Sollievo della Sofferenza Hospital
- ✓ Caretta-Net
- ✓ University of Passau

# Background (Demographic problem)

2012

2050

BACKGROUND

The number and percentages of people in need of advanced assistive technology are increasing every year. About 80 millions of Europeans have a disability.

The ratio of persons 65+ years of age to the labour force (15-64 years) will rise from 25% in 2005 to 31% in 2020 and further increase to 52% in 2050.(EUROSTAT). About 3 million of Italians have a disability that affects one or more of their major life activities. In 2025, over 26% of the Italian population will be over 65 years of age, with one in two working adults serving as informal caregivers.

Active ageing is actually one of the key topics of European research mainly due to rapidly population ageing, increasing cost of health care, and growing importance of living independently. Active ageing basically means helping people stay in charge of their own lives as long as possible as they age and, where possible, contribute to economy and society. In order to achieve this goal, assistive technologies and ambient assisted intelligence are applied to enable people to live at home longer and better by
tools (i.e. smart objects, intelligent devices) being sensitive and responsive to their presence, conditions and actions.

Background (People With Dementia: PWD)

✓ The number of people in the world with dementia will increase significantly by 2050.

✓ In 2010, the annual cost of dementia care was estimated at $604 billion. If dementia care was a company, it would be the world's largest by annual revenue.

✓ There will be at least 85% increase in these costs by 2030.

135M

76M

44M

2013   2030   2050

EUROPE

90% INCREASE

11 MILLION   21 MILLION
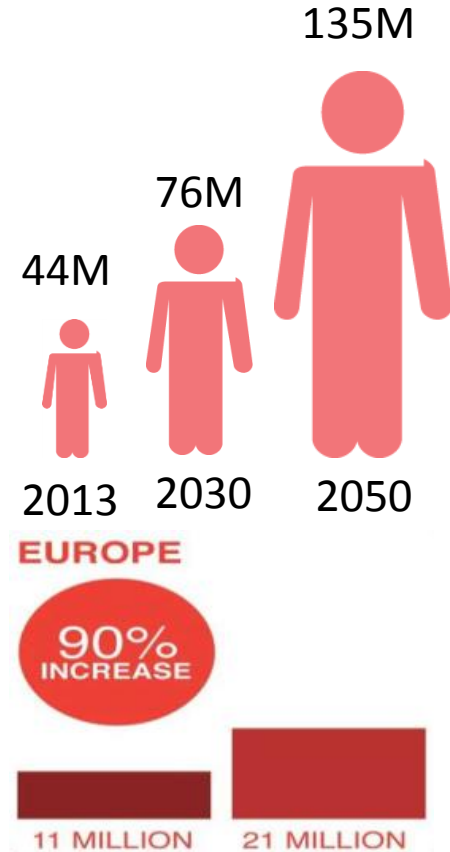
Dementia

▶ Another 20 people

▶ By 85 one person in every 3 will have dementia

▶ Dementia

  ▶ worsens over time,

  ▶ erodes your memory,

  ▶ language,

  ▶ communication,

  ▶ changes your moods and personality.
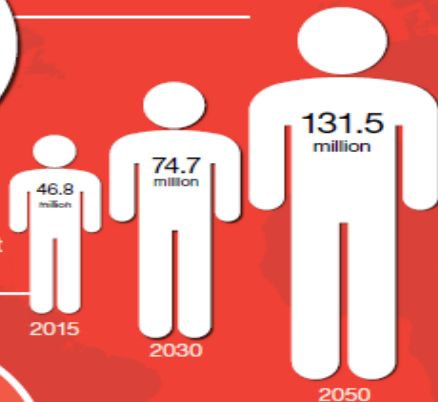
INFOGRAPHIC

The global impact of dementia

Around the world, there will be 9.9 million new cases of dementia in 2015,

one every 3 seconds

46.8 million people worldwide are living with dementia in 2015.

This number will almost double every 20 years.

46.8 million — 2015

74.7 million — 2030

131.5 million — 2050

68% 2050

Much of the increase will take place in low and middle income countries (LMICs): in 2015, 58% of all people with dementia live in LMICs, rising to 63% in 2030 and 68% in 2050.

The total estimated worldwide cost of dementia in 2015 is US$ 818 billion. By 2018, dementia will become a trillion dollar disease, rising to **US$ 2 trillion by 2030**

US$ 818 BILLION — 2015

US$ 1 TRILLION — 2018

If global dementia care were a country, it would be the

18th largest economy

in the world exceeding the market values of companies such as Apple and Google

Apple $742 billion
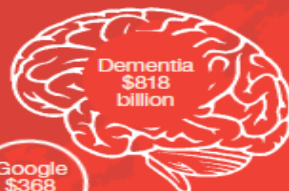
Google $368 billion

Dementia $818 billion

(source: Forbes 2015 ranking).

EUROPE 10.5 MILLION

THE AMERICAS 9.4 MILLION

AFRICA 4.0 MILLION

ASIA 22.9 MILLION

This map shows the estimated number of people living with dementia in each world region in 2015.

We must now involve more countries and regions in the global action on dementia.

Older People Most at Risk

▶ Loneliness major public health challenge

  ▶ In the UK 1/3 of people with dementia reported that there were lonely (Alzheimer UK 2013)
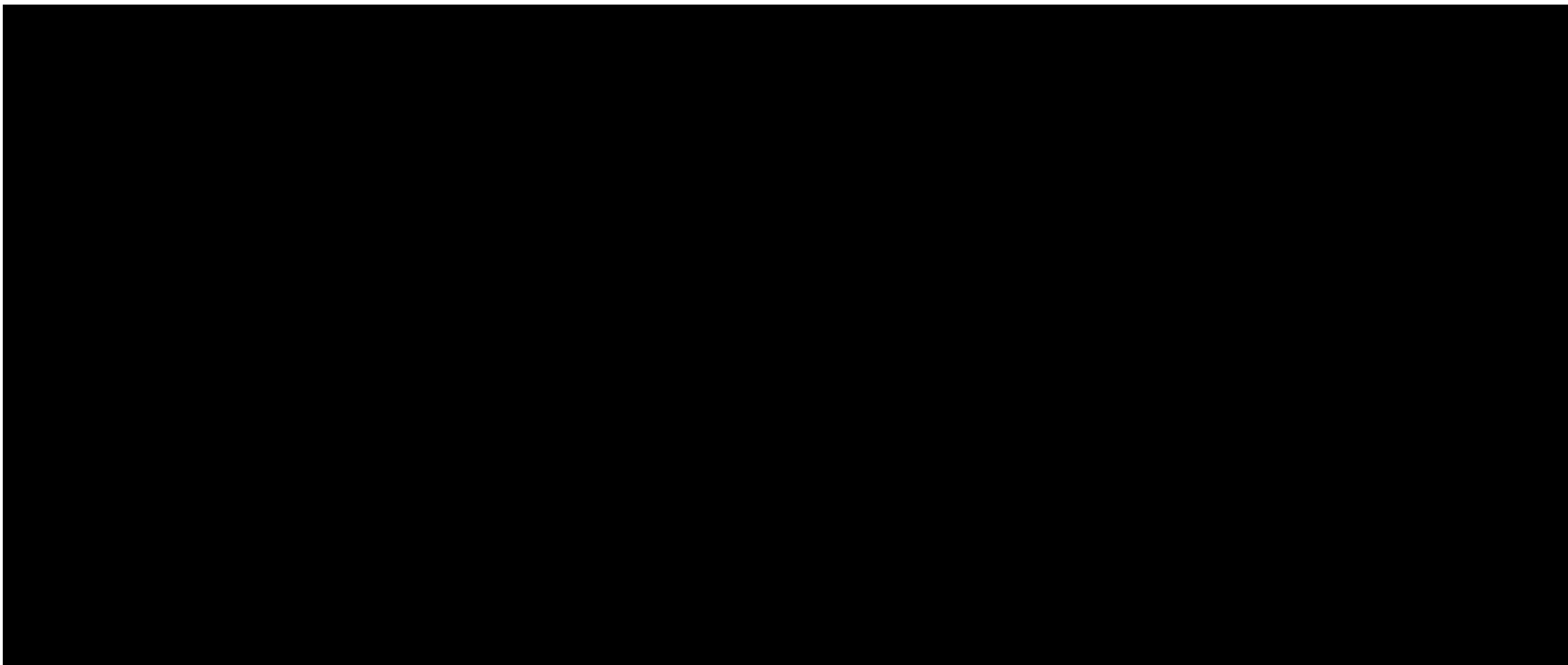
Electric Calendar

Scheduler

Medication reminder

Locator

Picture phone

Simple remote control

Wheelchair with automatic brake

3

MARIO objectives 1/2

- ✓ To address and make progress on the challenging problems of **loneliness**, **isolation** and **dementia** in older persons through multi-faceted interventions delivered by service robots.

- ✓ To determine the health status thorugh a a **comprehensive geriatric assessment (CGA)**.

- ✓ The **use of near state of the art robotic platforms** that are <u>flexible</u>, <u>modular</u> friendly, <u>low cost</u> and close to <u>market ready</u>.

MARIO objectives 2/2

- ✓ To make MARIO capable to support and receive "**robot applications**" similar to the developer and app community for smartphones.

- ✓ Through novel advances in **machine learning techniques** and **semantic analysis methods** to make MARIO more personable, useful, and accepted by end users (e.g. gain perception of non-loneliness).

- ✓ To bring MARIO **service robot concepts out of the lab and into industry**.

We connect older persons to <u>4+ main target groups</u>:

✓Their **community** and **social support programs**

✓The **medical community** and **caregivers**

✓Their **social network** (family & friends)

✓Their **interests** (stimulation for cognitive aspects)

+The **developer community** that can make available new robot applications

People that will benefit

- ✓ **Nurse practitioners** / **Dementia specialists**

- ✓ **Geriatricians**

- ✓ **Psychologists**

- ✓ **PWD** and their **carers**

- ✓ **Technologists**

MARIO will:

- ✓ perform **CGA**
- ✓ be a benchmark for robotics in **dementia**
- ✓ be a tool for assisting elderly to stay **connected**
- ✓ be **acceptable** by end-users
- ✓ be a **market leader** and a commercially viable product
- ✓ provide an **ethical framework** for assisted living
- ✓ provide a framework for **measuring life improvements**
- ✓ **save money**

Connect with friends, family and doctors

See what's happening in your world

Have some fun

Take care of everyday things

Call your family?

Call your doctor?

Call your carer?

Something else?

How is your family?

Read the papers?

How are your friends?

Something else?

Read a book

Watch a movie

Listen to some music

Show me more…

What's in schedule today

Help me with cooking

Help me with dressing up

Show me more…

Principles for UI

✓ No memorability

- The user interaction between users and robot should not require users to remember keywords, phrases, etc.

- It should subtly help/direct user to give the correct command

✓ Number of choices

- No more than 4 options are shown to the user at a specific point of time.

✓ Discoverability

- Users should be able to find what they want to do with the robot and how to ask it easily

Principles for UI

✓ **Levels of specificity**

- Every request from the user is first analysed (by the decision manager) to identify how specific it is.
  - Mario, I want to have some fun
  - Mario, I want call my family
  - Mario, I want to see a movie
- Based on this the interaction is starting from the appropriate level

✓ **Indirect feedback included**

- If the robot does not understand a request a dialogue is initiated that helps the user give feedback
- Potential annoyance in this case is dealt with a sense respect from the robot.

✓ **Interruptions**

- If a user expresses a request in the middle of another process that needs to be stopped a short notice appears to make sure that the request is valid and if the user needs to return back to initial activity after the interruption

MARIO

LA VALUTAZIONE GERIATRICA MULTIDIMENSIONALE

COSA E' ?
Processo diagnostico multidimensionale, usualmente interdisciplinare

A COSA SERVE?
Caratterizzare gli aspetti medici, psicologici e funzionali dell'Anziano

SCOPO
Sviluppare un piano globale di trattamento e di follow-up a lungo termine

VALUTAZIONE GERIATRICA MULTIDIMENSIONALE

Visita medica, Farmaci Indice di comorbidità

Fabbisogno assistenza: Medico, IP, FKT

Barthel, ADL IADL, Tinetti

MMSE, SPMSQ, GDS

Esami bioumorali, valutazione dietetica

Indice Exton-Smith MNA

Valutazione sanitaria

Valutazione funzionale, cognitiva, tono umore

Valutazione biologica e Nutrizionale

Situazione abitativa Attivazione della rete

Valutazione efficacia copertura bisogno

Valutazione sociale

1) profilo clinico
2) rischio patologico
3) potenziale residuo

Formulazione progetto assistenziale

LA VALUTAZIONE GERIATRICA MULTIDIMENSIONALE

Comprehensive geriatric assessment has become the internationally established method to assess elderly people in clinical practice. It is a process of specialist elderly care delivered by a multidisciplinary team to establish an elderly person's medical, psychological and functional capability, so that a plan for treatment and follow-up can be developed.

Rubenstein LZ, Stuck AE, Siu AL, Wieland D. Impacts of geriatric evaluation and management programs on defi ned outcomes: overview of the evidence. *J Am Geriatr Soc 1991; **39 (9 pt 2): 8S–16S;*** discussion 7S–8S.

LA VALUTAZIONE GERIATRICA MULTIDIMENSIONALE

Frail elderly people receiving inpatient comprehensive geriatric assessment on specialist elderly care wards are more likely to return home, are less likely to have cognitive or functional decline, and have lower in-hospital mortality rates than do those who are admitted to a general medical ward setting. Complex interventions based on comprehensive geriatric assessment delivered to elderly people in the community can increase the likelihood of continuing to live at home, mainly through a reduced need for care-home admission and fewer falls but the most frail patients seem to receive the least benefit
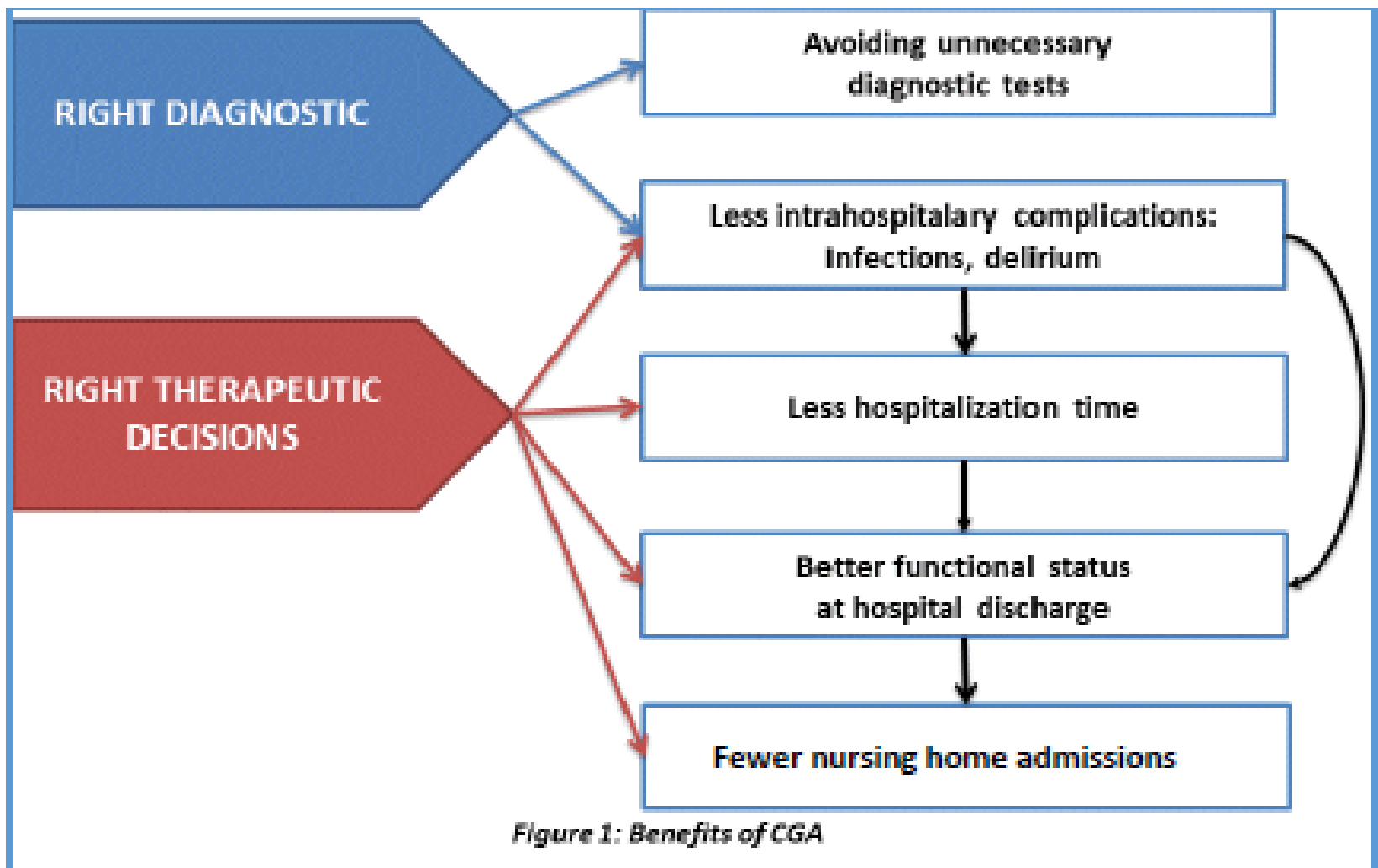
Figure 1: Benefits of CGA

Comprehensive Geriatric Assessment (CGA) meta-analysis 20 RCT, 1985-2002, 10.427 in-patients

Reference
Physical Function
Cognition
Alive at home
Mortality 6 mo.
Mortality 12 mo.

1.72
2.0
1.16
0.73
0.95

0.5　1　2　3　4

Ellis, Br Med Bull 2004;71: 45-59

Geriatric Care Management for Low-Income Seniors: a randomized controlled trial

951 subjects ≥ 65 years, income < 200% of federal poverty level,
2-years home care management by a nurse, social worker, GP, a geriatric team
8 care protocols for common geriatric conditions

SF-36 scales: PCS, MCS; ADL, IADL, days in bed
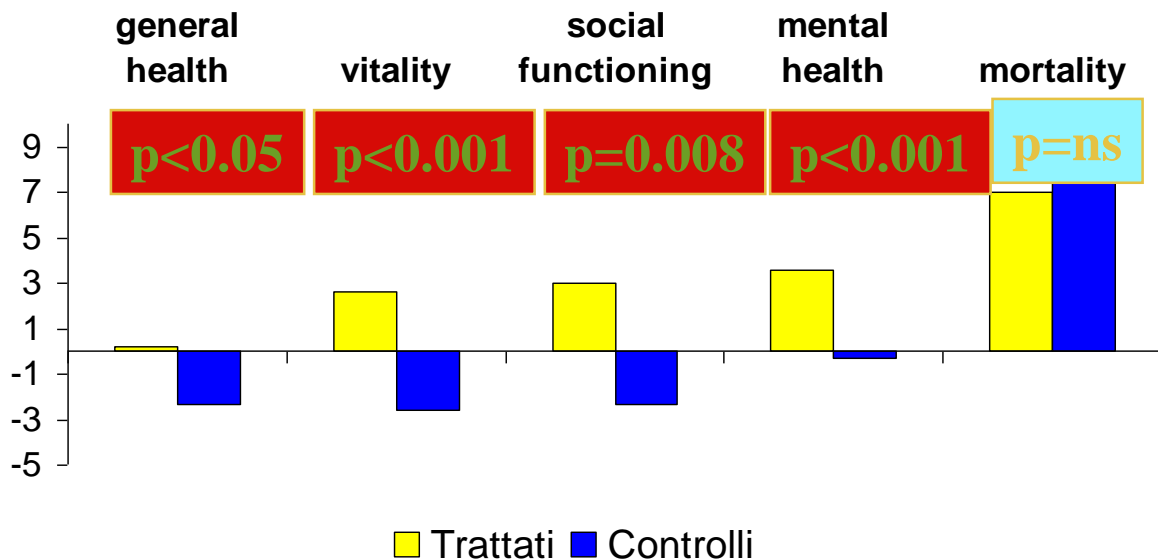
Walking or Falls
Incontinence
Depression
Sensory impairment

Preventive care
Continuity of care
Medication use
End-of-life care

Evaluation of a Frailty Index based on a Comprehensive Geriatric Assessment (FI-CGA) in a population based study

Use of clinical services by level of frailty

	Clinical Frailty Scale			
	Very fit	**Apparently vulnerable**	**Mild frail**	**Severely frail**
Ambulatory health services (Mean annual visit)	10.6	13.1	16.6	22.5
Community services (Mean hours, yearly)	40.1	70.9	85.4	117.8
Hospitalization (% in last year)	11.1	20.9	33.5	69.5

Development and Validation of a CGA-based Multidimensional Prognostic Index (MPI)

- Activities of Daily Living (ADL)	6	items
- Instrumental Activities of Daily Living (IADL)	8	items
- Short Portable Mental Status Questionnaire (SPMSQ)	10	items
- Mini-Nutritional Assessment (MNA)	18	items
- Exton-Smith Scale	5	items
- Cumulative Illness Rating Scale_comorbility (CIRS)	14	items
- Number of drugs	1	
- Social index	1	
TOTAL	63	items

M. P. I.

	Mild	Moderate	Severe
SCORE	0.18±0.09	0.48±0.09	0.77±0.08
RANGE	0.00-0.33	0.34-0.66	0.67-1.0

SHORT PORTABLE MENTAL STATUS QUESTIONNAIRE
(segnare gli errori)

Che giorno è oggi (giorno, mese, anno) ?		1
Che giorno è della settimana ?		1
Come si chiama questo posto ?		1
Quale è il suo indirizzo di domicilio ?		1
Qualti anni ha ?		1
Quando è nato ?		1
Chi è il Presidente della Repubblica ? (oppure chi è il Papa ?)		1
Chi era il Presidente precedente ?		1
Quale è il cognome da ragazza di sua madre ?		1
Esegua la seguente operazione: 20 - 3 (eseguire per tre volte: 17, 14, 11)		1
TOTALE		

Autonomia nelle attività della vita quotidiana (ADL) *

A) FARE IL BAGNO (vasca, doccia, spugnature)	
- Fa il bagno da solo (entra ed esce dalla vasca da solo).	1
- Ha bisogno di assistenza soltanto nella pulizia di una parte del corpo (es. dorso).	1
- Ha bisogno di assistenza per più di una parte del corpo.	0

B) VESTIRSI (prendere i vestiti dall'armadio e/o cassetti, inclusa biancheria intima, vestiti, uso delle allacciature e delle bretelle se utilizzate)	
- Prende i vestiti e si veste completamente senza bisogno di assistenza.	1
- Prende i vestiti e si veste senza bisogno di assistenza eccetto che per allacciare le scarpe.	1
- Ha bisogno di assistenza nel prendere i vestiti o nel vestirsi oppure rimane parzialmente o completamente svestito	0

C) TOILETTE (andare nella stanza da bagno per la minzione e l'evacuazione, pulirsi , rivestirsi)	
- Va in bagno, si pulisce e si riveste senza bisogno di assistenza (può utilizzare mezzi di supporto come bastone, deambulatore o seggiola a rotelle, può usare vaso da notte o comoda).	1
- Ha bisogno di assistenza nell'andare in bagno o nel pulirsi o nel rivestirsi o nell'uso del vaso da notte o della comoda.	0
- Non si reca in bagno per l'evacuazione.	0

D) SPOSTARSI	
- Si sposta dentro e fuori dal letto ed in poltrona senza assistenza (eventualmente con canadesi o deambulatore)	1
- Compie questi trasferimenti se aiutato.	0
- Allettato, non esce dal letto.	0

E) CONTINENZA DI FECI E URINE	
- Controlla completamente feci e urine.	1
- "Incidenti" occasionali.	0
- Necessita di supervisione per il controllo di feci e urine, usa il catetere, è incontinente.	0

F) ALIMENTAZIONE	
- Senza assistenza.	1
- Assistenza solo per tagliare la carne o imburrare il pane.	1
- Richiede assistenza per portare il cibo alla bocca o viene nutrito parzialmente o completamente per via parenterale	0

TOTALE _____

Instrumental Activities of Daily Living (IADL)

Instructions: Circle the scoring point for the statement that most closely corresponds to the patient's current functional ability for each task. The examiner should complete the scale based on information about the patient from the patient him-/herself, informants (such as the patient's family member or other caregiver), and recent records.

A. Ability to use telephone	Score
1. Operates telephone on own initiative; looks up and dials numbers, etc.	1
2. Dials a few well-known numbers	1
3. Answers telephone but does not dial	1
4. Does not use telephone at all	0

B. Shopping	
1. Takes care of all shopping needs independently	1
2. Shops independently for small purchases	0
3. Needs to be accompanied on any shopping trip	0
4. Completely unable to shop	0

C. Food preparation	
1. Plans, prepares, and serves adequate meals independently	1
2. Prepares adequate meals if supplied with ingredients	0
3. Heats and serves prepared meals, or prepares meals but does not maintain adequate diet	0
4. Needs to have meals prepared and served	0

D. Housekeeping	
1. Maintains house alone or with occasional assistance (e.g., "heavy work domestic help")	1
2. Performs light daily tasks such as dishwashing, bed making	1
3. Performs light daily tasks but cannot maintain acceptable level of cleanliness	1
4. Needs help with all home maintenance tasks	1
5. Does not participate in any housekeeping tasks	0

E. Laundry	Score
1. Does personal laundry completely	1
2. Launders small items; rinses stockings, etc.	1
3. All laundry must be done by others	0

F. Mode of transportation	
1. Travels independently on public transportation or drives own car	1
2. Arranges own travel via taxi, but does not otherwise use public transportation	1
3. Travels on public transportation when assisted or accompanied by another	1
4. Travel limited to taxi or automobile with assistance of another	0
5. Does not travel at all	0

G. Responsibility for own medications	
1. Is responsible for taking medication in correct dosages at correct time	1
2. Takes responsibility if medication is prepared in advance in separate dosages	0
3. Is not capable of dispensing own medication	0

H. Ability to handle finances	
1. Manages financial matters independently (budgets, writes checks, pays rent and bills, goes to bank), collects and keeps track of income	1
2. Manages day-to-day purchases, but needs help with banking, major purchases, etc.	1
3. Incapable of handling money	0

(Lawton & Brody, 1969)

GERIATRIC DEPRESSION SCALE SHORT FORM

	Si	No
❖In generale è soddisfatto della sua vita?	0	1
❖Si sente spesso annoiato?	1	0
❖Si sente spesso privo di aiuto?	1	0
❖Preferisce stare a casa piuttosto che uscire a fare cose nuove?	1	0
❖Le sembra che la sua condizione sia indegna di essere vissuta?	1	0

Legenda
0 – 1: normale – non necessita di ulteriore valutazione
2 – 5: depressione possibile – proseguire con la valutazione completa

Cumulative Illness Rating (CIRS)

	ASSENTE	LIEVE	MODERATO	GRAVE	MOLTO GRAVE
1. Cardiologico	1	2	3	4	5
2. Ipertensione arteriosa (severità)	1	2	3	4	5
3. Vascolare, linfatico, emopoietico	1	2	3	4	5
4. Respiratorio (al di sotto della laringe)	1	2	3	4	5
5. Occhio, orecchio, naso, gola, laringe	1	2	3	4	5
6. Gastro-enterico alto	1	2	3	4	5
7. Intestino, ernia	1	2	3	4	5
8. Epatico (solo fegato)	1	2	3	4	5
9. Renale (solo rene)	1	2	3	4	5
10. Genito-urinario (uretere-genitali)	1	2	3	4	5
11. Muscolo- scletrico e cute	1	2	3	4	5
12. Neurologica (escluse le demenze)	1	2	3	4	5
13. Endocrino, metabolico, infettivo, tossico	1	2	3	4	5
14. Cognitivo-psichiatrico comportamentale	1	2	3	4	5

Indice di severità	Indice di comorbilità
media dei punteggi delle prime 13 categorie (esclusa la patologia psichiatrica-comportamentale)	numero totale delle prime 13 categorie in cui si ottiene un punteggio ≥ 3

SCALA DI EXTON-SMITH
(valutazione del rischio di lesioni da decubito)

Condizioni generali		**Incontinenza**	
Pessime	**1**	Doppia	**1**
Scadenti	**2**	Abituale	**2**
Discrete	**3**	Occasionale	**3**
Buone	**4**	Assente	**4**
Stato mentale		**Mobilità**	
Stuporoso	**1**	Immobile	**1**
Confuso	**2**	Molto limitata	**2**
Apatico	**3**	Leggerm. Limitata	**3**
Lucido	**4**	Normale	**4**
Deambulazione		**TOTALE** …………………………	
Allettato	**1**	*Punteggio 16-20: rischio minimo*	
Sedia a rotelle	**2**	*" 10-15: rischio medio*	
Si aiuta	**3**	*" 5-9: rischio elevato*	
Normale	**4**		

MINI NUTRITIONAL ASSESSMENT (MNA) *

A) Valutazione Antropometrica

1) Indice di massa corporea (BMI) Peso=_____kg Altezza=_____cm	0 BMI <19	1 BMI= 19-20	2 BMI= 21-22	3 BMI ≥ 23
2) Circonferenza metà braccio (MAC) in cm	0 MAC<21	0.5 MAC ≤ 22	1 MAC > 22	
3) Circonferenza polpaccio (CC) in cm	0 CC < 31	1 CC ≥ 31		
4) Perdita recente di peso (ultimi 3 mesi)	0 perdita > 3 Kg	1 perdita non nota	2 perdita tra 1-3 Kg	3 non perdita

B) Valutazione Generale

5) Vive indipendentemente?	0= no	1= si	
6) Assume più di 3 farmaci/die?	0= si	1= no	
7) Ha sofferto di stress psicologici o malattie acute? (ultimi 3 mesi)	0= si	2= no	
8) Mobilità	0 a letto o carrozzina	1 si può alzare	2 non ha problemi
9) Problemi neuropsicologici?	0 demenza o depressione grave	1 demenza o depressione lieve	2 non ha problemi
10) Piaghe da decubito	0= si	1= no	

C) Valutazione Alimentare

11) Quanti pasti completi consuma al giorno?	0 1 pasto	1 2 pasti	2 3 pasti
12) Consuma: 0 = 1 SI 0.5 = 2 SI 1= 3 SI	Almeno 1 pasto al giorno a base di latticini? SI NO	1 o 2 volte a settimana uova o legumi? SI NO	Mangia tutti i giorni carne o pesce? SI NO
13) Consuma almeno 2 volte al giorno frutta o verdura?	0= no	1= si	
14) L'appetito si è ridotto negli ultimi 3 mesi per vari motivi?	0 notevole riduzione	1 moderata riduzione	2 nessuna variazione
15) Quanti liquidi assume al giorno?	0 < 5 bicchieri	0.5 5-9 bicchieri	1 > 9 bicchieri
16) Come mangia?	0 con assistenza	1 con difficoltà ma da solo	2 da solo

D) Autovalutazione

17) Il paziente ritiene di avere problemi nutrizionali?	0 si	1 non lo sa, forse	2 mancano problemi nutrizionali	
18) In confronto ai suoi coetanei come considera il suo stato di salute?	0 meno buono	0.5 non lo sa	1 abbastanza buono	2 migliore
	TOTALE (max 30 punti)			
Punteggio: ≥ 24=ben nutrito, 17-23.5 = a rischio di malnutrizione, <17= malnutrito				

* Vellas B et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999; 15: 116-22.

ECHORD++ CALL FOR R&D PROPOSALS IN HEALTHCARE

Public end-user Driven Technological Innovation Robotics for the Comprehensive Geriatric Assessment Challenge

Robot

A **robot is a mechanical or virtual intelligent agent that can perform tasks** automatically or with guidance, typically by remote control. In practice a robot is usually an electro-mechanical machine that is guided by computer and electronic programming. Robots can be autonomous, semi-autonomous, or remotely controlled. Robots range from humanoids such as ASIMO and TOPIO to nano robots, swarm robots, industrial robots, military robots, mobile, and servicing robots. By mimicking a lifelike appearance or automating movements, a robot may convey a sense that it has intent or agency of its own.

Robotics

Robotics is the branch of technology that deals with the design, construction, operation, and application of robots.

Assistive robotics

An assistive robot is a device that can sense, process sensory information, and perform actions that benefit people with disabilities and seniors.

Ausili robotici
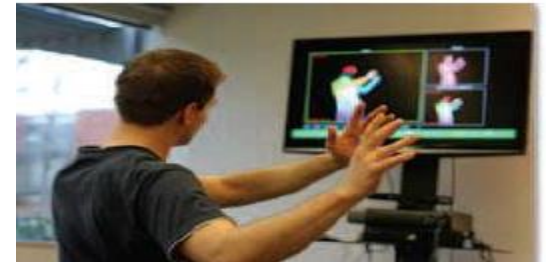
Robot Humanoid

A humanoid is a robot that is based on the general structure of a human, such as a robot that walks on two legs and has an upper torso, or a robot that has two arms, two legs and a head.

Yang Yang

a   b   c   d   e   f   g

a	**AVA, from iROBOT USA 2011** AVA combines your Apple iPad (or any Android device) with a mobile robot that uses multiple sensors for 3D-location awareness and to build a map of, perhaps, your entire home. In addition to sonar and laser sensors, AVA uses two PrimeSense sensors--yes the same ones found in Kinect for Xbox 360-- to build a three-dimensional map of its environment.
b	**RP-7 Robot, from In Touch Health** Robot for telepresence. Unparalleled two-way, audio-video communications, movement in any direction, control interface, SenseArray 360 System, a network of infrared proximity sensors and a bumper around the base of the platform. Rental cost cost : almost $100,000 a year in some american hospitals since 2006
c	**Robosoft's Kompaï R&D** A robot to assist seniors and dependent persons at home. This first commercial generation is for developers who want to implement their own assistance scenarios, **Price starting from 20K€** and walker to physically assist people to standing up and walking.
d	**Nursebot** From Carnegie Mellon University USA is mobile, personal service robot that assists elderly people suffering from chronic disorders in their everyday life. This is an autonomous mobile robot that lives in private homes. Among others, it verbalises scripted reminders to people
e	**Bandit I and II** from University of Southern C USA to serve as an expressive tool for human-robot interaction. The work of USC is a good illustration showing what a cognitive robot can do
f	**RIBA-2**, a new version, has been introduced in 2011, a robot designed for lifting and carrying humans
g	**uBOT-5** from University of Massachusetts Amherst follows its owner around the house, takes care of the cleaning, gives reminders about medication, helps with shopping, communicates with doctor, recognizes when owner has fallen or become unresponsive introduced in 2007. Cost is around 65000$

a	**Asimo** From Honda, 6.4 km/h, recognizes voices, avoids crashing with environment, serves beverages, escorts humans, conducts orchestra, walks up and down stairs, grasps objects
b	**Emiew 2** from Hitachi, up tp 6 km/h, recognition of voices and sounds from a distance, two arms with hands for fetching and carrying objects, collision avoidance, 4 wheels-modus, lifts leg 3 cm
c,d	**Monty and Dexter** from anybots USA two arms, two wheels or 2 legs, can unload the dishwasher, unpacks packages, makes coffee. At this stage, Monty is not autonomous, only remotely controlled.
e	**REEM-B** from PAL TECHNOLOGY ROBOTICS, walks dynamically, recognises and grasps objects, lifts heavy weights, walking around in buildings avoiding obstacles, speaks, accepts voice commands, recognises faces, reminds of appointements
f	**Nao** from ALDEBARAN Robotics, plays soccer, recognises voices, final goal: security assistance, information, home assistance

Companion Robot

Paro Therapeutic Robot

PARO is an advanced interactive robot developed by AIST, a leading Japanese industrial automation pioneer. It allows the documented benefits of animal therapy to be administered to patients in environments such as hospitals and extended care facilities where live animals present treatment or logistical difficulties.

•Paro has been found to reduce patient stress and their caregivers
•Paro stimulates interaction between patients and caregivers
•Paro has been shown to have a Psychological effect on patients, improving thier relaxation and motivation
•Paro improves the socializazation of patients with each other and with caregivers
•World's Most Therapeutic Robot certified by Guinness World Records

MOBISERV "An Integrated Intelligent Home Environment for the Provision of Health, Nutrition and Well-Being Services to Older Adults"

MOBISERV (2009-2013) was a collaborative European research project that responded to call ICT-2009.7.1 ICT and Aging, that grouped care organizations, universities, research institutions and industry to design, develop and evaluate technologies that leveraged the ROBOSOFT platform to support independent living of elders in their homes or nursing homes with particular focus on health, nutrition, well-being, and safety. The developed solution included (i) a social companion robot, an autonomous robot with processing power, data storage, sensors, machine learning algorithms, touch screen, speech synthesis and recognition, (ii) wearable smart clothes, implementing functionalities such as monitoring of vital signs or sleeping patterns, and detection of falls, (iii) a smart home environment which includes smart sensors, optical recognition units, and home automation elements, to detect eating, drinking, activity, dangerous patterns MOBISERV was a success and made an excellent start toward the development and diffusion of robot-facilitated care for our aging population.


SoundBot project

DOMEO " DOMESTIC ROBOT FOR ELDERLY ASSISTANCE"

ECONOMIC ASPECTS

A $50,000 assistive robot can be amortized over three years if it replaces attendant care at $6 per hour and is used for two 4-hour shifts per day. (2005)
[Hammel J and Symons J (1993) Evaluating reasonable accommodation in the workplace: A team approach. *Work, 3(4): pp. 12-20.]*
The running costs of installation, training, customization, maintenance, and repair will be the dominant factor in determining overall cost, **not the cost of the manipulator itself.**
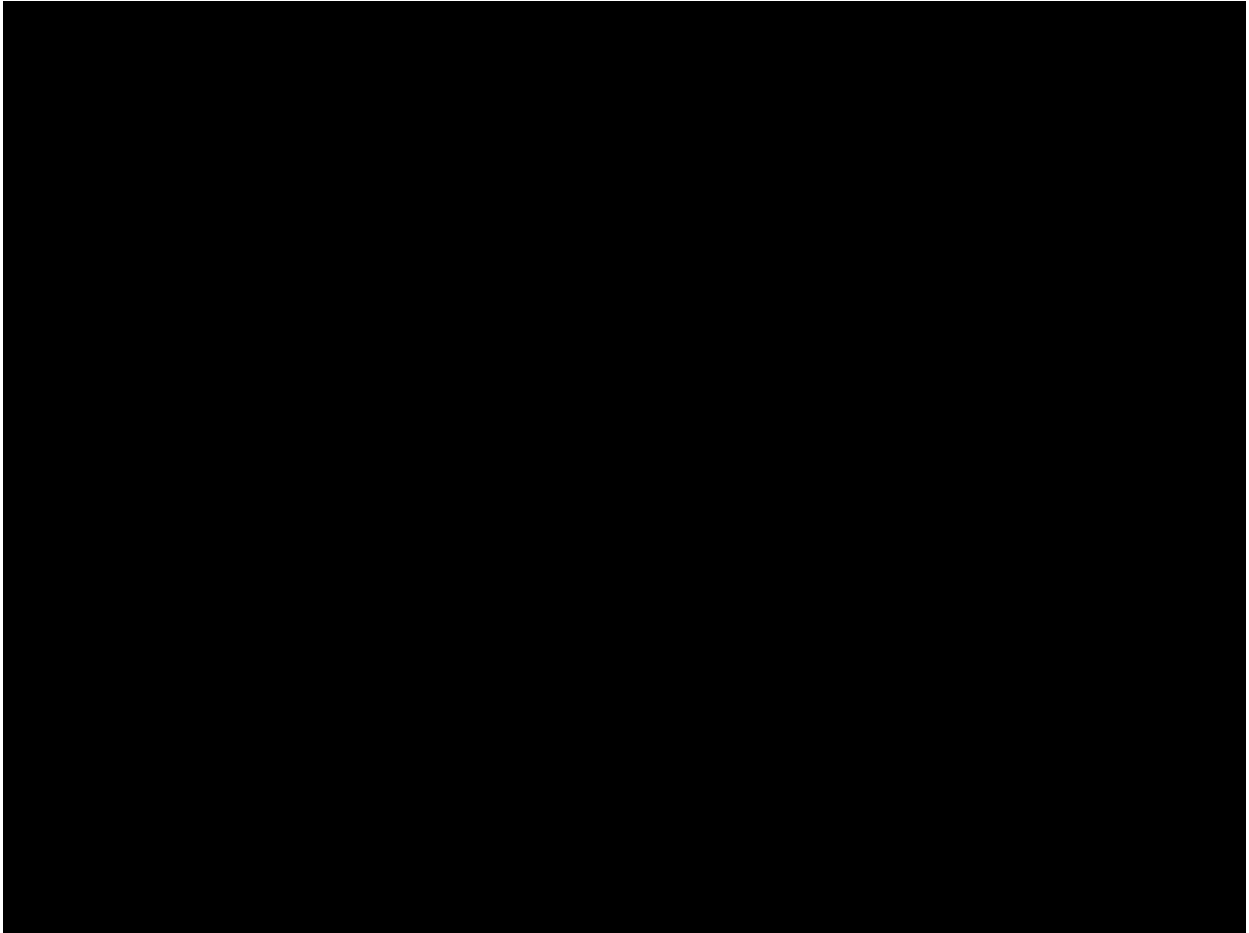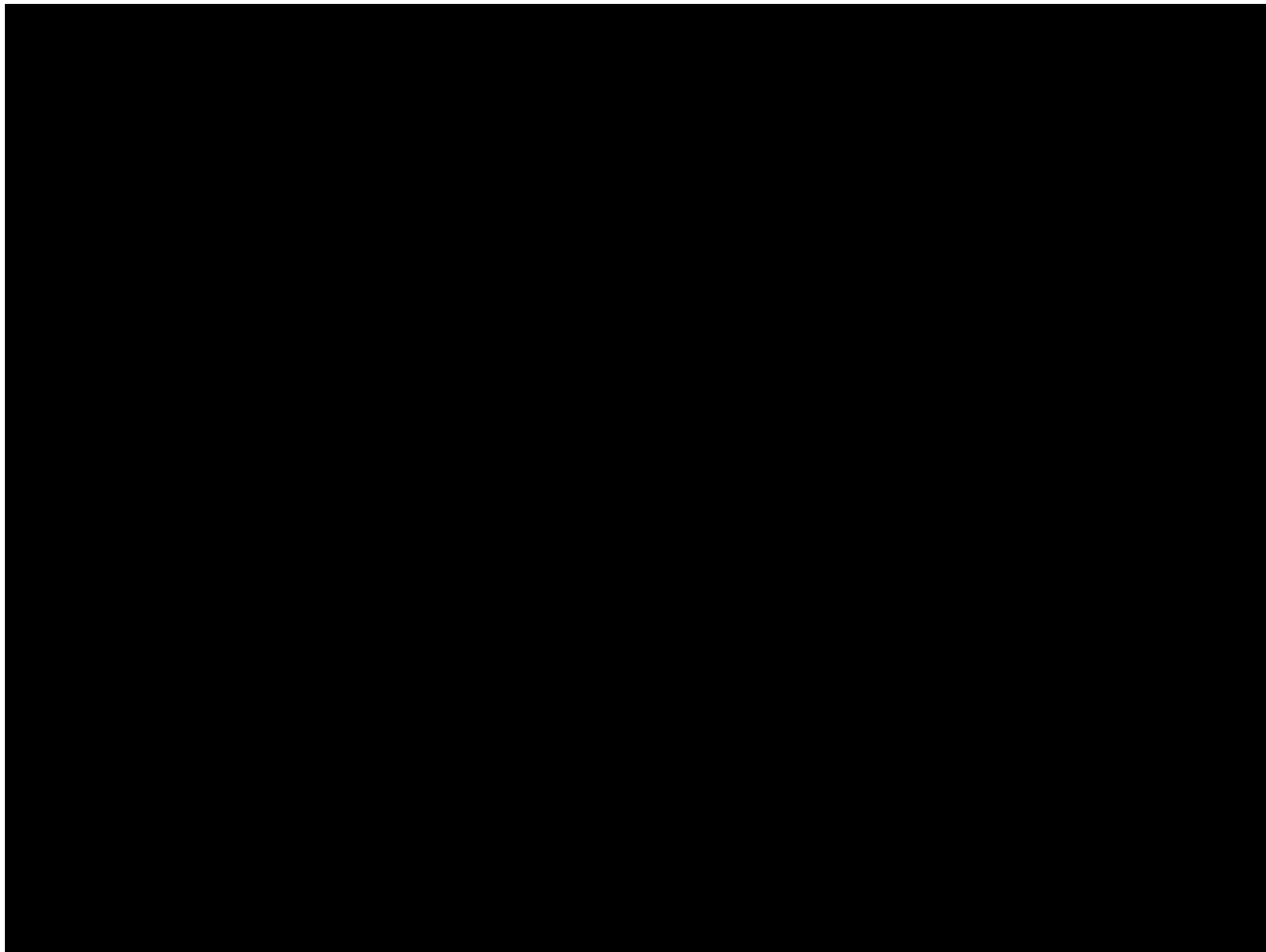
KOMPAI PLATFORM

from Robosoft

Robot semantics based on Semantic Web practices and technologies: Linked Data principles, RDF, SPARQL, RIF.

Semantic Web-based machine reading/listening in robots. FRED, will be extended and improved for dealing with context-based grounding and interpretation of natural language input.

"Entity-centric" knowledge management: each entity and its relations have a public identity that provides a first "grounding" to the knowledge used by robots. Such identity is given by resolvable URIs that use simple Web and Internet protocols to provide useful knowledge as a representative of real world entities.

Mario Ontology Network (MON) will reuse and extend the Ontologies for Robotics and Automation. MON will evolve over time by integrating ontologies emerging from interaction with assisted humans, sensors or with other robots.

Ability to advance robot knowledge by learning new ontology patterns from its experience with users and the robot network in place. New emerging patterns and expressions are fed back to the robot's cognitive system in order to address emotional needs of end users in compliance with the social and behavioral objectives of MARIO.

Robot social skills: a sentiment analysis framework based on deep parsing of natural language and supported by MON will deal with moods and expression recognition providing robots.

MARIO as it appears to be
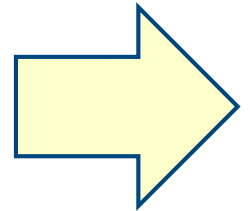
Major milestones

M12

✓Implementation of the platform hardware, sensor and communication modifications. 12 Service Robots ready to be used for validation.

M24

✓Execution of the health aspects of the proposal related to loneliness, isolation, resilience and dementia.

✓Execution of the CGA and MPI assessments with service robots.

✓Implementation of the personalised semantic interaction.

✓Implementation of the MARIO's behavioural and social skills.

M34

✓Technical Integration Complete & Replication Plan Ready

M36

✓Validation completed in homes, communities and hospitals.

Conclusion

The MARIO project represents a novel approach to design and put in action a companion robot and its ambitious outcomes will be: to facilitate and support people with dementia and their caregivers, reduce social exclusion and isolation and determine health status changes autonomously, thus improving the care process.

Thank you

✓ **Aknowledgements**

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✓ **Contact**

http://www.mario-project.eu/